

# Graphene Chemical Sensor Project

Completed Technology Project (2012 - 2014)



## Project Introduction

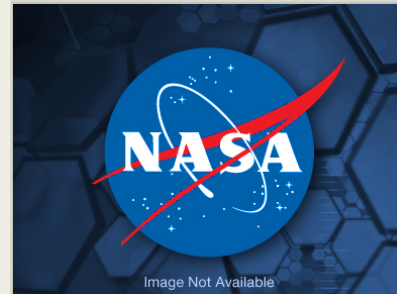
Develop graphene based miniaturized chemical sensors that will be able to detect gaseous and volatile molecules with high sensitivity, good reproducibility and wide operating environment, including extreme conditions.

The sensor uses graphene based devices to sense the surface potential of a graphene channel exposed to an analyte. When analyte molecules adsorb onto the graphene surface, they induce a local change in electrical resistance. This effect is very pronounced in graphene due to the high surface area; high electrical conductivity; and inherent low noise, which makes the changes in resistance detectable.

## Anticipated Benefits

This technology will benefit missions in several lines of NASA business, including Earth Science, Heliophysics and Planetary Science. It will also address strategic goals of increasing cost efficiency, miniaturization, and extreme environment capability.

The developed technology has a number of commercial applications. It will be useful for many commercial areas such as medical diagnosis, industrial process monitoring, volcanology, environmental monitoring, leak detection, and military use for the detection of chemical, biological agents and explosives.



Graphene Chemical Sensor Project

## Table of Contents

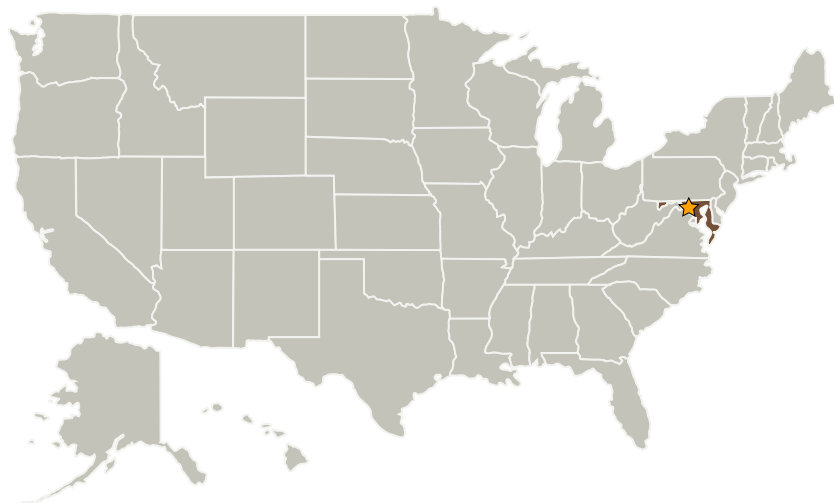
Project Introduction	1
Anticipated Benefits	1
Primary U.S. Work Locations and Key Partners	2
Project Website:	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	3
Technology Areas	3

## Graphene Chemical Sensor Project

Completed Technology Project (2012 - 2014)



## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Goddard Space Flight Center (GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland

## Primary U.S. Work Locations

Maryland

## Project Website:

<http://sciences.gsfc.nasa.gov/sed/>

## Organizational Responsibility

## Responsible Mission Directorate:

Mission Support Directorate (MSD)

## Lead Center / Facility:

Goddard Space Flight Center (GSFC)

## Responsible Program:

Center Independent Research &amp; Development: GSFC IRAD

## Project Management

## Program Manager:

Peter M Hughes

## Project Manager:

Terry Doiron

## Principal Investigator:

Mahmooda Sultana

## Co-Investigators:

 Shahid Aslam  
 George Manos  
 Mary J Li

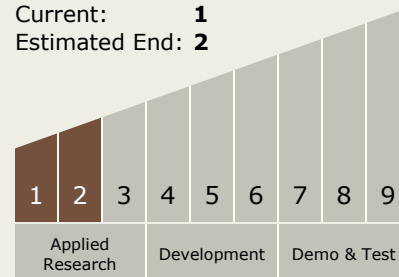
# Graphene Chemical Sensor Project

Completed Technology Project (2012 - 2014)



## Technology Maturity (TRL)

Start: **1**  
Current: **1**  
Estimated End: **2**



## Technology Areas

### Primary:

- TX08 Sensors and Instruments
  - └ TX08.3 In-Situ Instruments and Sensors
    - └ TX08.3.4 Environment Sensors

### Other/Cross-cutting:

- TX06 Human Health, Life Support, and Habitation Systems
  - └ TX06.4 Environmental Monitoring, Safety, and Emergency Response
    - └ TX06.4.1 Sensors: Air, Water, Microbial, and Acoustic
- TX08 Sensors and Instruments
  - └ TX08.3 In-Situ Instruments and Sensors

*Continued on following page.*

## Graphene Chemical Sensor Project

Completed Technology Project (2012 - 2014)



### Technology Areas (cont.)

- └ TX08.3.6 Extreme Environments Related to Critical System Health Management